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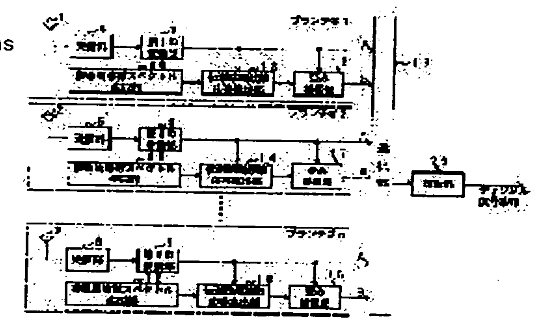
(54) OFDM DIVERSITY RECEPTION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a diversity reception device improving the deterioration of a reception characteristic in a mtultiplex reflected radio wave transmission environment in the radio communication/broadcasting system of an OFDM (orthogonal frequency division/multiplex) transmission system.
SOLUTION: OFDM reception signals from reception parts 4-6 connected to antennas 1-3 are converted into frequency spectrums in first conversion parts 7-9 and a transmission line frequency response is obtained in transmission line frequency response calculation parts 13-15 from the OFDM reception signal frequency spectrums and reference frequency spectrums from reference frequency spectrum generation parts 10-12. The distortion of the OFDM reception signal frequency spectrum is compensated by using the corresponding transmission line frequency response in distortion compensation parts 16-18. A selection part 19 selects a second input signal corresponding to a first input signal whose amplitude or power becomes maximum with the OFDM reception signal frequency spectrum and the frequency spectrum after compensation as the first and second input signals. A demodulation part 20 demodulates a digital signal group from the output signal of the selection part 19.



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CLAIMS

[Claim(s)]
[Claim 1] OFDM diversity reception equipment characterized by constituting two or more diversity branches characterized by providing the following, choosing the diversity branch from which the amplitude or power of OFDM input-signal frequency spectrum or a transmission-line frequency response serves as the maximum, and performing diversity reception. A receiving means to receive an OFDM (orthogonal frequency division multiplex) signal through an antenna, and to output an OFDM input signal, respectively. The 1st conversion means which changes an OFDM input signal into frequency spectrum, and outputs OFDM input-signal frequency spectrum. A transmission-line frequency response calculation means to compute a transmission-line frequency response from this OFDM input-signal frequency spectrum and reference frequency spectrum.
[Claim 2] OFDM diversity reception equipment characterized by providing the following. Two or more receiving meanses to receive an OFDM (orthogonal frequency division multiplex) signal through an individual antenna, and to output an OFDM input signal, respectively. Two or more 1st conversion meanses to change the aforementioned OFDM input signal into frequency spectrum, respectively. At least one reference frequency spectrum generation means to generate the reference frequency spectrum to the aforementioned OFDM input signal. Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and the aforementioned reference frequency spectrum which are outputted from the conversion means of the above 1st, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using the aforementioned corresponding transmission-line frequency response from the conversion means of the above 1st, The frequency spectrum after distortion compensation which makes frequency spectrum outputted from the conversion means of the above 1st, respectively the 1st input signal, and is outputted from the aforementioned distortion compensation means, respectively as the 2nd input signal A selection means to choose and output the 2nd input signal corresponding to the 1st input signal from which an amplitude or power serves as the maximum, and a recovery means to recover a digital signal sequence from the output signal of the aforementioned selection means.
[Claim 3] OFDM diversity reception equipment characterized by providing the following. Two or more receiving meanses to receive an OFDM (orthogonal frequency division multiplex) signal through an individual antenna, and to output an OFDM input signal, respectively. Two or more 1st conversion meanses to change the aforementioned OFDM input signal into frequency spectrum, respectively. At least one reference frequency spectrum generation means to generate the reference frequency spectrum to the aforementioned OFDM input signal. Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and the aforementioned reference frequency spectrum which are outputted from the conversion means of the above 1st, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using the aforementioned corresponding transmission-line frequency response from the conversion means of the above 1st, The frequency spectrum after distortion compensation which makes the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means, respectively the 1st input signal, and is outputted from the aforementioned distortion compensation means, respectively as the 2nd input signal A selection means to choose and output the 2nd input signal corresponding to the 1st input signal from which an amplitude or power serves as the maximum, and a recovery means to recover a digital signal sequence from the output signal of the aforementioned selection means.
[Claim 4] OFDM diversity reception equipment characterized by providing the following. Two or more receiving meanses to receive an OFDM (orthogonal frequency division multiplex) signal through an individual antenna, and to output an OFDM input signal, respectively. Two or more 1st conversion meanses to change the aforementioned OFDM input signal into frequency spectrum, respectively. At least one reference frequency spectrum generation means to generate the reference frequency spectrum to the aforementioned OFDM input signal. Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and the aforementioned reference frequency spectrum which are outputted from the conversion means of the above 1st, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using the aforementioned corresponding transmission-line frequency response from the conversion means of the above 1st, A selection means to choose and output the 1st input signal from which frequency spectrum after distortion compensation outputted from the aforementioned distortion compensation means, respectively is made into the 1st input signal, and an amplitude or power serves as

the maximum, and a recovery means to recover a digital signal sequence from the output signal of the aforementioned selection means.

[Claim 5] OFDM diversity reception equipment characterized by providing the following. Two or more receiving meanses to receive an OFDM (orthogonal frequency division multiplex) signal through an individual antenna, and to output an OFDM input signal, respectively. Two or more 1st conversion meanses to change the aforementioned OFDM input signal into frequency spectrum, respectively. At least one reference frequency spectrum generation means to generate the reference frequency spectrum to the aforementioned OFDM input signal. Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and the aforementioned reference frequency spectrum which are outputted from the conversion means of the above 1st, respectively, The transmission-line frequency response which makes frequency spectrum outputted from the conversion means of the above 1st, respectively the 1st input signal, and is computed by the aforementioned transmission-line frequency response calculation means, respectively as the 2nd input signal The 1st input signal from which an amplitude or power serves as the maximum, and the 2nd input signal corresponding to it are chosen. A selection means to output as the 1st output signal and 2nd output signal, respectively, a distortion compensation means to compensate distortion of the 1st output signal of the above of the aforementioned selection means using the 2nd output signal of the above of the aforementioned selection means, and a recovery means to recover a digital signal sequence from the output signal of the aforementioned distortion compensation means.

[Claim 6] OFDM diversity reception equipment characterized by providing the following. Two or more receiving meanses to receive an OFDM (orthogonal frequency division multiplex) signal through an individual antenna, and to output an OFDM input signal, respectively. Two or more 1st conversion meanses to change the aforementioned OFDM input signal into frequency spectrum, respectively. At least one reference frequency spectrum generation means to generate the reference frequency spectrum to the aforementioned OFDM input signal. Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and the aforementioned reference frequency spectrum which are outputted from the conversion means of the above 1st, respectively, The frequency spectrum which makes the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means, respectively the 1st input signal, and is outputted from the conversion means of the above 1st, respectively as the 2nd input signal The 1st input signal from which an amplitude or power serves as the maximum, and the 2nd input signal corresponding to it are chosen. A selection means to output as the 1st output signal and 2nd output signal, respectively, a distortion compensation means to compensate distortion of the 2nd output signal of the above of the aforementioned selection means using the 1st output signal of the above of the aforementioned selection means, and a recovery means to recover a digital signal sequence from the output signal of the aforementioned distortion compensation means.

[Claim 7] The claim 2 characterized by inserting a filtering means to filter the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means, respectively between the aforementioned transmission-line frequency response calculation means and the aforementioned distortion compensation means, or OFDM diversity reception equipment of four given in any 1 term.

[Claim 8] OFDM diversity reception equipment according to claim 5 or 6 characterized by inserting a filtering means to filter the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means, respectively between the aforementioned transmission-line frequency response calculation means and the aforementioned selection means.

[Claim 9] OFDM diversity reception equipment according to claim 7 or 8 characterized by providing the following. For the aforementioned filtering means, the filtering bandwidth which considers as an input the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means is an adjustable filter means. The 2nd conversion means which changes into a transmission-line time response the transmission-line frequency response computed by the aforementioned transmission-line frequency response calculation means. A propagation-delay-time measurement means to measure the propagation delay time of multihop transmission environment using the transmission-line time response changed by the conversion means of the above 2nd. A filtering bandwidth setting means to set up the filtering bandwidth of the aforementioned filter means based on the measurement result of the aforementioned propagation-delay-time measurement means.

[Claim 10] The claim 2 characterized by providing further a frequency spectrum selection means to output alternatively a second change tone means to carry out the second change tone of the digital signal sequence to which it restored by the aforementioned recovery means, and to generate second change tone frequency spectrum, and the aforementioned second change tone frequency spectrum and the aforementioned reference frequency spectrum to the aforementioned transmission-line frequency response calculation means, or OFDM diversity reception equipment of six given in any 1 term.

[Claim 11] The aforementioned selection means is the claim 2 characterized by having two or more synthetic meanses to compound the amplitude or power of each line spectrum which constitutes the 1st input signal of the above, and a comparison means to measure the output of the synthetic means of these plurality, and performing selection operation based on the comparison result of this comparison means, or OFDM diversity reception equipment of six given in any 1 term.

[Claim 12] The aforementioned selection means is the claim 2 characterized by having a comparison means to measure the amplitude or power of line spectrums of the same frequency out of the line spectrum which constitutes the 1st input signal of the above, and performing selection operation based on the comparison result of this

comparison means, or OFDM diversity reception equipment of six given in any 1 term.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the OFDM receiving set in the base station and terminal office of the radio communications system which performs a radio transmission with an orthogonal frequency division multiplex (OFDM) method, or the receiving station of the broadcast system by the OFDM method, and relates to the OFDM diversity reception equipment which realizes transmission of quality information under inferior radio propagation environment especially.
[0002]
[Description of the Prior Art] Now, although, as for terrestrial TV broadcasting, the analog method is adopted, the shift to digitization is due to be started around A.D. 2000. Terrestrial TV broadcasting has a serious problem of the ghost obstacle with which a receiving picture deteriorates [the area covered in one sending station] extremely under the influence of multiple reflection radio wave propagation (multi-pass) peculiar to radio radio wave propagation for a latus reason. The scale of the multi-pass in this terrestrial TV broadcasting is farther [than the scale of the target multi-pass in radio communications systems, such as carrying and a car telephone,] large, and cannot respond any longer with an adaptation automatic equalization vessel effective in the cure against a multi-pass.
[0003] Then, the orthogonal frequency division multiplex (OFDM) transmission system in which a quality information transmission is possible is due to have resistance theoretically also in inferior multi-pass propagation environment, and to adopt as a digital transmission method of terrestrial TV broadcasting. The guard period which copied some transmission-wave forms (symbol) is prepared in the OFDM transmission signal, and this guard period absorbed the multi-pass propagation below guard period length, and has prevented fatal degradation of television quality.
[0004] Moreover, the multi-pass-proof transmission characteristic of such an OFDM transmission system attracts attention not only with terrestrial TV broadcasting but with wide band radio communications systems, such as multimedia communication which will be developed with the public network or the yard network from now on, and concrete technical examination to utilization is advanced positively.
[0005] Furthermore, since the single-frequency network (SFN) simultaneously transmitted on the same frequency can build the same content taking advantage of a multi-pass-proof transmission characteristic, an OFDM transmission system can improve useless frequency use that transmit frequencies must be changed for every area like before, and is a very effective transmission system also in respect of compression of a use frequency band.
[0006] However, it is not necessarily completely protected from degradation of the receiving property under the influence of the influence of severe frequency-selective phasing produced by multi-pass propagation although it says that the OFDM transmission system is [how] excellent in a multi-pass-proof transmission characteristic, the Doppler shift produced in the case of move reception, or time phasing. Radio-transmission technology high stability and far more nearly quality than carrying and the car telephone of the existing with main speech communication is required of transmission of the highly minute picture especially expected by digital terrestrial TV broadcasting or next-generation multimedia communication, and it is immediately asked for realization of the receiving method and equipment which realizes a better receiving property.
[0007] Furthermore, the technology of transmitting transmission of a highly minute picture which has a lot of information from the field of a frequency deployment in a narrow radio band is needed for transmission of a highly minute picture, and adoption of modulation techniques, such as an efficient multiple-value QAM modulation technique under the radio propagation environment where movement was taken into consideration, must be considered. However, the efficient modulation technique represented by the QAM modulation is inferior in respect of a noise-proof property or an interference-proof property, and distortion has the fault of being weak.
[0008] Therefore, in the receiving set received in the place of the distant place which is distant from a sending station or a base station, or the receiving set which receives while moving, where reception in the low signal-to-noise-ratio state and radio-wave-propagation distortion are received, in order to receive, a receiving property deteriorates very simply and the problem of it becoming impossible to realize the information transmission in satisfactory quality arises. Especially, in terrestrial TV broadcasting, for a latus reason, covering area poses a serious problem extremely, and application of an effective upgrading means is desired.
[0009] Generally, there is diversity reception as an improvement means of the receiving property under inferior multiplex radio-wave-propagation environment or move receiving environment. As a diversity reception method, the antenna change diversity reception which chooses the receiving antenna to which power serves as the maximum

out of RF (radio frequency) signal received by two or more receiving antennas, and restores to a digital signal sequence is in use conventionally.

[0010] However, at an OFDM transmission system, after carrying out frequency conversion of the input signal to baseband signaling and changing into frequency spectrum per symbol, in order to restore to a digital signal sequence for each [which constitutes frequency spectrum] line spectrum of every, to an OFDM transmission signal, there is a problem that a big effect is not acquired, by the antenna change diversity reception changed by RF signal. Since a receiving property completely changed with each line spectrums which constitute frequency spectrum when severe frequency-selective phasing arises especially, change diversity from which the optimal receiving property is acquired per line spectrum was desired.

[0011]

[Problem(s) to be Solved by the Invention] As mentioned above, although the multi-pass-proof transmission characteristic of an OFDM transmission system is used effectively, in order to realize transmission of information quality in all the places in vast covering area, and high definition, in the radio / broadcast system which performs the radio transmission of a digital signal sequence with an orthogonal frequency division multiplex method (OFDM), application of the degradation remedy of the receiving property in severe multiple reflection radio-wave-propagation environment and the degradation remedy of the receiving property at the time of move reception is needed.

[0012] Especially in the future multimedia communication and the future digital terrestrial broadcasting from which transmission of image information becomes main, application of efficient modulation techniques, such as a multiple-value QAM modulation, becomes indispensable, and development of the remedy of the receiving property in an OFDM transmission system and the diversity reception equipment with which a good receiving property is especially acquired also to frequency-selective phasing at the time of OFDM transmission-system adoption is desired.

[0013] Therefore, this invention aims at offering the OFDM diversity reception equipment which improves degradation of the receiving property produced in the multiple reflection radio-wave-propagation environment and the move receiving environment in radio / broadcast system of an OFDM transmission system.

[0014]

[Means for Solving the Problem] A receiving means for this invention to receive an OFDM (orthogonal frequency division multiplex) signal through an antenna, and to output an OFDM input signal, respectively in order to solve the above-mentioned technical problem, The 1st conversion means which changes an OFDM input signal into frequency spectrum, and outputs OFDM input-signal frequency spectrum, Two or more diversity branches which include a transmission-line frequency response calculation means to compute a transmission-line frequency response, respectively are constituted from this OFDM input-signal frequency spectrum and reference frequency spectrum. It is characterized by choosing the diversity branch from which the amplitude or power of OFDM input-signal frequency spectrum or a transmission-line frequency response serves as the maximum, and performing diversity reception.

[0015] The 1st OFDM diversity reception equipment concerning this invention more specifically Two or more receiving meanses to receive an OFDM signal through an individual antenna and to output an OFDM input signal, respectively, Two or more 1st conversion meanses to change an OFDM input signal into frequency spectrum, respectively, At least one reference frequency spectrum generation means to generate the reference frequency spectrum to an OFDM input signal, Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and reference frequency spectrum which are outputted from the 1st conversion means, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using a corresponding transmission-line frequency response from the 1st conversion means, The frequency spectrum after distortion compensation which makes frequency spectrum outputted from the 1st conversion means, respectively the 1st input signal, and is outputted from a distortion compensation means, respectively as the 2nd input signal It is characterized by providing a selection means to choose and output the 2nd input signal corresponding to the 1st input signal from which an amplitude or power serves as the maximum, and a recovery means to recover a digital signal sequence from the output signal of this selection means.

[0016] The 2nd OFDM diversity reception equipment concerning this invention Two or more receiving meanses to receive an OFDM signal through an individual antenna and to output an OFDM input signal, respectively, Two or more 1st conversion meanses to change an OFDM input signal into frequency spectrum, respectively, At least one reference frequency spectrum generation means to generate the reference frequency spectrum to an OFDM input signal, Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and reference frequency spectrum which are outputted from the 1st conversion means, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using a corresponding transmission-line frequency response from the 1st conversion means, The frequency spectrum after distortion compensation which makes the transmission-line frequency response computed by the transmission-line frequency response calculation means, respectively the 1st input signal, and is outputted from a distortion compensation means, respectively as the 2nd input signal It is characterized by providing a selection means to choose and output the 2nd input signal corresponding to the 1st input signal from which an amplitude or power serves as the maximum, and a recovery means to recover a digital signal sequence from the output signal of this selection means.

[0017] The 3rd OFDM diversity reception equipment concerning this invention Two or more receiving meanses to receive an OFDM signal through an individual antenna and to output an OFDM input signal, respectively, Two or

more 1st conversion meanses to change an OFDM input signal into frequency spectrum, respectively, At least one reference frequency spectrum generation means to generate the reference frequency spectrum to an OFDM input signal, Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and reference frequency spectrum which are outputted from the 1st conversion means, respectively, A distortion compensation means to compensate distortion of the frequency spectrum outputted, respectively using a corresponding transmission-line frequency response from the 1st conversion means, A selection means to choose and output the 1st input signal from which frequency spectrum after distortion compensation outputted from a distortion compensation means, respectively is made into the 1st input signal, and an amplitude or power serves as the maximum, It is characterized by providing a recovery means to recover a digital signal sequence from the output signal of this selection means.

[0018] Thus, an OFDM signal is received with the receiving means containing two or more antennas, each OFDM input signal is changed into frequency spectrum, a transmission-line frequency response is calculated from such OFDM input-signal frequency spectrum and reference frequency spectrum, and distortion of OFDM input-signal frequency spectrum is further compensated with the 1st, the 2nd, and 3rd OFDM diversity reception equipment concerning this invention using a corresponding transmission-line frequency response.

[0019] And (a) [whether the OFDM input-signal frequency spectrum after the distortion compensation corresponding to the OFDM input-signal frequency spectrum from which an amplitude or power serves as the maximum is chosen, and it restores to a digital signal sequence, and] Or (b) [whether the OFDM input-signal frequency spectrum after the distortion compensation corresponding to the transmission-line frequency response with which an amplitude or power serves as the maximum is chosen, and it restores to a digital signal sequence, and] Or (c) An amplitude or power chooses the OFDM input-signal frequency spectrum after the distortion compensation used as the maximum, and restores to a digital signal sequence.

[0020] Therefore, since the diversity reception which acquires the optimal receiving property per line spectrum also in the situation that a receiving property completely changes with each line spectrums which constitute frequency spectrum by frequency-selective phasing becomes possible, degradation of the receiving property produced in multihop transmission environment or a move receiving environment is improved effectively.

[0021] The 4th OFDM diversity reception equipment concerning this invention Two or more receiving meanses to receive an OFDM signal through an individual antenna and to output an OFDM input signal, respectively, Two or more 1st conversion meanses to change an OFDM input signal into frequency spectrum, respectively, At least one reference frequency spectrum generation means to generate the reference frequency spectrum to an OFDM input signal, Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and reference frequency spectrum which are outputted from the 1st conversion means, respectively, The transmission-line frequency response which makes frequency spectrum outputted from the 1st conversion means, respectively the 1st input signal, and is computed by the transmission-line frequency response calculation means, respectively as the 2nd input signal The 1st input signal from which an amplitude or power serves as the maximum, and the 2nd input signal corresponding to it are chosen. A selection means to output as the 1st output signal and 2nd output signal, respectively, It is characterized by providing a distortion compensation means to compensate distortion of the 1st output signal of a selection means using the 2nd output signal of this selection means, and a recovery means to recover a digital signal sequence from the output signal of this distortion compensation means.

[0022] The 5th OFDM diversity reception equipment concerning this invention Two or more receiving meanses to receive an OFDM signal through an individual antenna and to output an OFDM input signal, respectively, Two or more 1st conversion meanses to change an OFDM input signal into frequency spectrum, respectively, At least one reference frequency spectrum generation means to generate the reference frequency spectrum to an OFDM input signal, Two or more transmission-line frequency response calculation meanses to compute two or more transmission-line frequency responses from the frequency spectrum and reference frequency spectrum which are outputted from the 1st conversion means, respectively, The frequency spectrum which makes the transmission-line frequency response computed by these transmission-lines frequency response calculation means, respectively the 1st input signal, and is outputted from the 1st conversion means, respectively as the 2nd input signal The 1st input signal from which an amplitude or power serves as the maximum, and the 2nd input signal corresponding to it are chosen. A selection means to output as the 1st output signal and 2nd output signal, respectively, It is characterized by providing a distortion compensation means to compensate distortion of the 2nd output signal of a selection means using the 1st output signal of this selection means, and a recovery means to recover a digital signal sequence from the output signal of this distortion compensation means.

[0023] thus, with the 4th and 5th OFDM diversity reception equipment concerning this invention Receive an OFDM signal with the receiving means containing two or more antennas, and each OFDM input signal is changed into frequency spectrum. After calculating a transmission-line frequency response from such OFDM input-signal frequency spectrum and reference frequency spectrum, (d) [whether the transmission-line frequency response corresponding to the OFDM input-signal frequency spectrum and this from which an amplitude or power serves as the maximum is chosen, and] Or (e) After choosing the OFDM input-signal frequency spectrum corresponding to the transmission-line frequency response and this from which an amplitude or power serves as the maximum, Distortion of the selected OFDM input-signal frequency spectrum is compensated using the selected transmission-line frequency response, and a digital signal sequence is recovered from the OFDM input-signal frequency spectrum after this distortion compensation.

[0024] Therefore, there is an advantage that a distortion compensation means can be managed also with the situation that a receiving property completely changes with each line spectrums which constitute frequency spectrum by frequency-selective phasing one while degradation of the receiving property produced in multihop-transmission environment or a move receiving environment is improved effectively, since the diversity reception which acquires the optimal receiving property per line spectrum becomes possible.
[0025] In this invention, it is distorted with the transmission-line frequency response calculation means in the 1st, the 2nd, or 3rd OFDM diversity reception equipment. between compensation meanses Insert a filtering means to filter the transmission-line frequency response computed by the transmission-line frequency response calculation means, respectively, or Or you may insert a filtering means to filter the transmission-line frequency response computed by the transmission-line frequency response calculation means, respectively between the transmission-line frequency response calculation meanses and selection meanses in the 4th or 5th OFDM diversity reception equipment. Since the noise component contained in a transmission-line frequency response is removed by insertion of such a filtering means, it becomes improvable [a receiving property / further].
[0026] The filtering bandwidth adjustable filter means which considers as an input the transmission-line frequency response with which this filtering means was specifically computed by the transmission-line frequency response calculation means, The 2nd conversion means which changes into a transmission-line time response the transmission-line frequency response computed by the transmission-line frequency response calculation means, A propagation-delay-time measurement means to measure the propagation delay time of multiple reflection radio-wave-propagation environment using the transmission-line time response changed by this 2nd conversion means, It is constituted by filtering bandwidth setting means to set up the filtering bandwidth of a filter means based on the measurement result of this propagation-delay-time measurement means. Thus, by measuring the propagation delay time of multihop transmission environment, the bandwidth of a filter means to filter a transmission-line frequency response can be set as the size suitable for propagation delay time, and it becomes possible to remove efficiently the noise component contained in a propagation-delay-time transmission-line frequency response.
[0027] In this invention, you may provide further a frequency spectrum selection means to output alternatively a second change tone means to carry out the second change tone of the digital signal sequence to which it restored by the recovery means, and to generate second change tone frequency spectrum, and second change tone frequency spectrum and reference frequency spectrum to a transmission-line frequency response calculation means.
[0028] A frequency spectrum selection means chooses reference frequency spectrum, when receiving the OFDM signal of the known data sequence included at the head of a slot in communication/broadcast system which transmits a digital signal sequence by the OFDM transmission system which used for example, slot composition, and when receiving the OFDM signal of the data sequence after it, it chooses second change tone frequency spectrum. Even when changing propagation environment in time since distortion of frequency spectrum can be compensated using the last transmission-line frequency response if a transmission-line frequency response is computed using second change tone frequency spectrum, it becomes possible to improve degradation of a receiving property.
[0029] In this invention, a selection means perform selection of the 1st input signal or the 1st input signal, and the 2nd input signal has two or more synthetic meanses compound the amplitude or power of each line spectrum which constitutes the 1st input signal according to the 1st example of composition, and a comparison means measure the output of the synthetic means of these plurality, and it is constituted so that selection operation may be performed based on the comparison result of this comparison means. By doing in this way, the diversity branch which was excellent in the receiving property can be chosen easily, and degradation of a receiving property is improved effectively.
[0030] Moreover, the selection means by the 2nd example of composition has a comparison means to measure the amplitude or power of line spectrums of the same frequency out of the line spectrum which constitutes the 1st input signal, and it is constituted so that selection operation may be performed based on the comparison result of this comparison means. By doing in this way, the diversity branch which was excellent in the receiving property for every line spectrum can be chosen easily, and degradation of a receiving property is improved still more effectively.
[0031]
[Embodiments of the Invention] Hereafter, the form of operation of this invention is explained in detail with reference to a drawing. (1st operation form) Drawing 1 is drawing showing the 1st operation form of the OFDM diversity reception equipment concerning this invention. As shown in this drawing, n diversity branch (only henceforth branch) #1 - #n are arranged. In each branch #1-#n, an OFDM signal is received by receiving antennas 1-3, and it is inputted into receive sections 4-6. Receive sections 4-6 output the baseband signaling from which the guard period was removed as an OFDM input signal including functions, such as removal of basic functions, such as amplification required in order to carry out frequency conversion of the OFDM signal of RF band to baseband signaling, frequency mixing, and a band limit, a synchronization, frequency amendment, and a guard period peculiar to an OFDM transmission system.
[0032] The OFDM input signal from receive sections 4-6 is inputted into the 1st transducer 7-9, and is changed into frequency spectrum (henceforth OFDM input-signal frequency spectrum) by transform processing which is represented by the fast Fourier transform (FFT).
[0033] In the reference frequency spectrum generation sections 10-12, the reference frequency spectrum to the OFDM input-signal frequency spectrum from the 1st transducer 7-9 is generated. In the transmission-line frequency response calculation sections 13-15, a transmission-line frequency response peculiar to each branch #1-

#n is computed using these OFDM input-signal frequency spectrum and reference frequency spectrum.
[0034] The OFDM input-signal frequency spectrum generated by the 1st transducer 7-9 is distorted, is inputted into the compensation sections 16-18, and is compensated by the transmission-line frequency response of each branch #1-#n by which distortion produced according to the multihop transmission environment included in OFDM input-signal frequency spectrum was computed in the transmission-line frequency response calculation sections 13-15. The frequency spectrum after distortion compensation generated in the OFDM input-signal frequency spectrum and the distortion compensation sections 16-18 which were generated by the 1st transducer 7-9 is inputted into the selection section 19 as the 1st input signal A and 2nd input signal B, respectively.
[0035] The selection section 19 compares the OFDM input-signal frequency spectrum generated by the 1st transducer 7-9 of branch #1 which is the 1st input signal A - #n, and chooses the OFDM input-signal frequency spectrum after distortion compensation inputted as the 2nd input signal B from the branch by which the OFDM input-signal frequency spectrum from which an amplitude or power serves as the maximum was generated. The OFDM input-signal frequency spectrum after distortion compensation chosen in the selection section 19 is inputted into the recovery section 20, and a digital signal sequence restores to it in this recovery section 20. The back is explained to a detail about the selection section 19.
[0036] Although the selection section 19 compares the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 and may choose a branch for every symbol of an OFDM input signal with this operation gestalt, propagation environment may choose a branch using the OFDM input-signal frequency spectrum which does not change rapidly and which was computed before fixed time when becoming with time. In this case, the branch to choose is set up beforehand or it becomes possible to set up the branch chosen for every number symbol.
[0037] Thus, according to this operation gestalt, the branch to which received power or an amplitude generates the greatest OFDM signal frequency spectrum out of two or more branch #1 - #n can be chosen, and a receiving property can be improved by recovering a digital signal sequence from the OFDM input-signal frequency spectrum after distortion compensation obtained by the selected branch.
[0038] The 1st example of composition of the selection section 19 is explained using the <selection section 19>, next drawing 2 . The 1st input signal A inputted into the selection section 19 from two or more branch #1-#n of drawing 1 is inputted into the synthetic sections 41-43, respectively. Although the 1st input signal A is OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 in the case of the 1st operation gestalt, in the operation gestalt mentioned later, the case of the output from the transmission-line frequency response calculation sections 13-15 also has the 1st input signal A. Usually, since the 1st transducer 7-9 performs a fast Fourier transform, the OFDM input-signal frequency spectrum computed by the 1st transducer 7-9 consists of two or more dispersed line spectrums, and consists of line spectrums also with the dispersed transmission-line frequency response computed using this OFDM input-signal frequency spectrum.
[0039] The synthetic sections 41-43 compound and output the 1st amplitude or power of two or more line spectrums of an input signal A. In this case, although the synthetic sections 41-43 usually compound the amplitude or power of a line spectrum for one symbol of an OFDM input signal, about several line spectrums are sufficient as the synthetic range, and it may be a line spectrum for a number symbol. [of frequency spectrum] The output of the synthetic sections 41-43 is inputted into a comparator 44 and the selector section 45.
[0040] In a comparator 44, the output of the synthetic sections 41-43 corresponding to each branch #1-#n is measured, a branch with the largest output is recognized, and the number of the recognized branch is notified to the selector section 45. The selector section 45 outputs the output signal of the synthetic section corresponding to the branch of the number notified from the comparator 44 as the 1st output signal.
[0041] Thus, according to the selection section 19 shown in drawing 2 , the branch from which the amplitude of two or more line spectrums of the 1st input signal A inputted from each branch #1-#n of drawing 1 or the synthetic result of power serves as the maximum is recognized. Since the 1st input signal A from the branch is chosen and outputted, a branch with the optimal receiving property is recognized for every line spectrum from the average receiving property of two or more line spectrums that it can set to each branch #1-#n. It becomes possible to choose the 1st input signal A from the branch, and a receiving property is improved more effectively.
[0042] Next, the 2nd example of composition of the selection section 19 is explained using drawing 3 . Drawing 3 is drawing showing operation of the selection section 19 based on the 2nd example of composition in the case of setting the number of branches to 2. The 1st input signal A consists of m dispersed line spectrums of frequency f1-fm. The selection section 19 measures the amplitude or power of line spectrums of the same frequency out of the 1st input signal A inputted from each branch. And the branch into which the line spectrum from which an amplitude or power serves as the maximum was inputted is chosen for every frequency of f1-fm in which a line spectrum exists.
[0043] Thus, since it is possible to choose the branch from which the amplitude or power of a line spectrum with which a line spectrum exists, and which was inputted as the 1st input signal for every frequency serves as the maximum according to the 2nd example of composition of the selection section 19, a receiving property is greatly improvable.
[0044] (2nd operation form) Drawing 4 is drawing showing the 2nd operation form of the OFDM diversity reception equipment of this invention. This operation form shows the form which shares the one reference frequency spectrum generation section 21 between each branch #1-#n paying attention to all the reference frequency spectrum generated in the reference frequency spectrum generation sections 10-12 in the 1st operation form shown in drawing 1 being the same. Therefore, an improvement of a receiving property is fundamentally realizable

similarly with the 1st operation form.
[0045] Also in this operation form, although the selection section 19 compares the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 and may choose a branch for every symbol of an OFDM input signal like the 1st operation form, propagation environment may choose a branch using the OFDM input-signal frequency spectrum which does not change rapidly and which was computed before fixed time when becoming with time.
[0046] (3rd operation form) Drawing 5 is drawing showing the 3rd operation form of the OFDM diversity reception equipment of this invention. In branch #1-#n, like the operation form of drawing 1 , it is distorted with a transmission-line frequency response, and the OFDM input-signal frequency spectrum after compensation is generated. The OFDM input-signal frequency spectrum after the transmission-line frequency response generated in the transmission-line frequency response calculation sections 13-15 and distortion compensation generated in the distortion compensation sections 16-18 is inputted into the selection section 19 as the 1st input signal A and 2nd input signal B, respectively.
[0047] The selection section 19 compares the transmission-line frequency response generated by branch #1 which is the 1st input signal A - #n, and chooses the branch by which the transmission-line frequency response with which an amplitude or power serves as the maximum was generated. And the OFDM input-signal frequency spectrum after distortion compensation which is the 2nd input signal B from the selected branch is chosen in the selection section 19, and gets over for a digital signal sequence by the recovery section 20.
[0048] Thus, a receiving property is improved in order to restore to a digital signal sequence by the frequency spectrum after distortion compensation which the power or the amplitude of a transmission-line frequency response becomes possible [choosing the branch which generates the greatest OFDM signal frequency spectrum] out of two or more branch #1 - #n, and is obtained by the selected branch according to this operation form.
[0049] In addition, this operation form is available also as composition in which the reference frequency spectrum generation section is contained in each branch #1-#n of every like the 1st operation form shown in drawing 1 , although the reference frequency spectrum generation section 21 shared by each branch #1-#n is used like the 2nd operation form shown in drawing 4 .
[0050] Moreover, also in this operation gestalt, propagation environment as well as the operation gestalt of drawing 1 becomes possible [choosing a branch using the transmission-line frequency response which does not change rapidly with time and which was computed before fixed time when becoming]. Therefore, the branch chosen beforehand can be set up, without choosing a branch for every symbol of an OFDM input signal, or the branch chosen for every number symbol can be set up.
[0051] (4th operation gestalt) Drawing 6 is drawing showing the 4th operation gestalt of the OFDM diversity reception equipment concerning this invention. This operation gestalt is replaced with the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 in the 2nd operation gestalt shown in drawing 4 , and makes OFDM input-signal frequency spectrum after distortion compensation outputted from the distortion compensation sections 16-18 the 1st input signal A to the selection section 19, and the 1st input signal A considers it as the composition inputted into the selection section 19 from each branch #1-#n.
[0052] In each branch #1-#n, after the OFDM signal received by receiving antennas 1-3 is changed into the baseband signaling from which the guard period was removed by receive sections 4-6, it is inputted into the 1st transducer 7-9, and serves as OFDM input-signal frequency spectrum by transform processing, such as a fast Fourier transform.
[0053] The OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 is distorted with the transmission-line frequency response calculation sections 13-15, and is inputted into the compensation sections 16-18. The transmission-line frequency response calculation sections 13-15 compute a transmission-line frequency response using OFDM input-signal frequency spectrum and the reference frequency spectrum generated by the reference frequency spectrum generation section 21. Distortion of OFDM input-signal frequency spectrum is compensated with the distortion compensation sections 16-18 by this transmission-line frequency response.
[0054] The distortion compensation sections 16-18 usually compensate frequency-selective phasing produced according to multiplex propagation environment with the signal by which amplitude, such as QAM, is modulated by carrying out the division of the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 with a transmission-line frequency response. However, phase distortion is compensated with phase modulation signals, such as QPSK, using a multiplier, without usually using the divider to which a circuit scale increases. Specifically, phase distortion is compensated with the distortion compensation sections 16-18 by carrying out the multiplication of the complex-conjugate signal of a transmission-line frequency response to the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9. In this case, since the amplitude of the OFDM input-signal frequency spectrum after the distortion compensation by the distortion compensation sections 16-18 is proportional to the amplitude component of the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9, it can also choose a branch for the amplitude or power of OFDM input-signal frequency spectrum after distortion compensation in the selection section 19 as compared with instead of [of the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9].
[0055] Then, with this operation gestalt, the branch by which the OFDM input-signal frequency spectrum after distortion compensation into which it was inputted by the selection section 19 as the 1st input signal A, and from which it is distorted, the OFDM input-signal frequency spectrum after compensation is compared, and an amplitude or power serves as the maximum was generated is chosen. The OFDM input-signal frequency spectrum after

distortion compensation which was inputted as the 1st input signal A from the selected branch and to which it is distorted and the OFDM input-signal frequency spectrum, i.e., an amplitude, or power after compensation serves as the maximum is outputted from the selection section 19, and gets over for a digital signal sequence by the recovery section 20.

[0056] In addition, although the OFDM input-signal frequency spectrum after distortion compensation into which the selection section 19 is inputted from each branch for every symbol of an OFDM input signal is compared and a branch may be chosen in this operation gestalt, propagation environment may choose a branch using the OFDM input-signal frequency spectrum after distortion compensation which does not change rapidly and which was computed before fixed time when becoming with time. Moreover, it is possible to apply this operation gestalt also to the composition in which the reference frequency spectrum generation section is contained in each branch #1-#n like the 1st operation gestalt shown in drawing 1 .

[0057] (5th operation gestalt) Drawing 7 is drawing showing the 5th operation gestalt of the OFDM diversity reception equipment concerning this invention. This operation gestalt has the composition of compensating distortion of the OFDM input-signal frequency spectrum of the selected branch, using the transmission-line frequency response of the branch chosen in the selection section 19, after choosing a branch by the selection section 19.

[0058] That is, the OFDM signal received by receiving antennas 1-3 in branch #1 - #n is changed into baseband signaling by receive sections 4-6, and serves as OFDM input-signal frequency spectrum by the 1st transducer 7-9 further. The transmission-line frequency response calculation sections 13-15 compute a transmission-line frequency response from OFDM input-signal frequency spectrum and the reference frequency spectrum generated by the reference frequency spectrum generation section 21. And OFDM input-signal frequency spectrum is inputted as the 1st input signal A, and a transmission-line frequency response is inputted into the selection section 19 as the 2nd input signal B, respectively.

[0059] The OFDM input-signal frequency spectrum generated by branch #1 which is the 1st input signal A - #n is compared, the branch by which the OFDM input-signal frequency spectrum from which an amplitude or power serves as the maximum was generated is chosen, the OFDM input-signal frequency spectrum and the transmission-line frequency response from the branch are distorted, and the selection section 19 is inputted into the compensation section 22. The selection section 19 can be similarly constituted with drawing 2 or drawing 3 having explained.

[0060] The distortion compensation section 22 compensates distortion of the OFDM input-signal frequency spectrum outputted from the selection section 19 using the transmission-line frequency response outputted from the selection section 19. And a digital signal sequence recovers from the OFDM input-signal frequency spectrum after the distortion compensation by this distortion compensation section 22 in the recovery section 20.

[0061] Thus, with this operation gestalt, in order to choose the branch which generates the OFDM input-signal frequency spectrum to which power or an amplitude serves as the maximum out of two or more branch #1 - #n, to compensate distortion of the spectrum of an OFDM input signal using the transmission-line frequency response obtained by this selected branch and to restore to a digital signal sequence by the OFDM input-signal frequency spectrum after distortion compensation, a receiving property is improved. Moreover, according to this operation gestalt, since the distortion compensation section can be managed with one, it has the advantage that a receiving set is miniaturized compared with an old operation gestalt.

[0062] In addition, this operation gestalt is available also as composition in which the reference frequency spectrum generation section is contained in each branch #1-#n of every like the 1st operation gestalt shown in drawing 1 , although the one reference frequency spectrum generation section 21 is shared between ** #1 - #n.

[0063] moreover, this operation gestalt -- also setting -- the 1- like the 4th operation gestalt, the selection section 19 compares OFDM input-signal frequency spectrum or a transmission-line frequency response for every symbol of an OFDM input signal, and you may make it choose a branch, and it may choose a branch using the OFDM input-signal frequency spectrum or the transmission-line frequency response computed before fixed time

[0064] (6th operation gestalt) Drawing 8 is drawing showing the 6th operation gestalt of the OFDM diversity reception equipment concerning this invention. After this operation gestalt chooses a branch by the selection section 19 like the 5th operation gestalt shown in drawing 7 , it enables it to manage the distortion compensation section with one by compensating distortion of the OFDM input-signal frequency spectrum of the selected branch using the transmission-line frequency response of the selected branch.

[0065] That is, in branch #1-#n, like the 5th operation gestalt, OFDM input-signal frequency spectrum is generated by the 1st transducer 7-9, and a transmission-line frequency response is generated by the transmission-line frequency response calculation sections 13-15. And with this operation gestalt, OFDM input-signal frequency spectrum is inputted into the selection section 19 for a transmission-line frequency response as the 2nd input signal B as the 1st input signal A, respectively.

[0066] The selection section 19 compares the transmission-line frequency response generated by branch #1 inputted as the 1st input signal A - #n, and chooses the branch by which the transmission-line frequency response with which an amplitude or power serves as the maximum was generated. The selection section 19 can be similarly constituted with drawing 2 or drawing 3 having explained. The OFDM input-signal frequency spectrum and the transmission-line frequency response of a branch which were chosen in this selection section 19 are inputted into the distortion compensation section 22.

[0067] The distortion compensation section 22 compensates distortion of the OFDM input-signal frequency

spectrum outputted from the selection section 19 using the transmission-line frequency response outputted from the selection section 19. And a digital signal sequence recovers from the OFDM input-signal frequency spectrum after the distortion compensation by this distortion compensation section 22 in the recovery section 20.
[0068] Thus, with this operation gestalt, in order to choose the branch which generates the transmission-line frequency response with which power or an amplitude serves as the maximum out of two or more branch #1 - #n, to compensate distortion of OFDM input-signal frequency spectrum using the transmission-line frequency response obtained by this selected branch and to restore to a digital signal sequence by the OFDM input-signal frequency spectrum after distortion compensation, a receiving property is improved. Moreover, according to this operation gestalt, like the 5th operation gestalt, since the distortion compensation section can be managed with one, there is an advantage that a receiving set is miniaturized.
[0069] (7th operation gestalt) Drawing 9 is drawing showing the 7th operation gestalt of the OFDM diversity reception equipment concerning this invention. This operation gestalt has composition which was distorted with the transmission-line frequency response calculation sections 13-15 in the 2nd operation gestalt shown in drawing 4 , and inserted the filtering sections 23-25 among the compensation sections 16-18, respectively, in order to remove distortion of the noise included during a transmission-line response.
[0070] In this operation gestalt, an OFDM input-signal frequency spectrum signal is computed by the 1st transducer 7-9 in branch #1 - #n in the same procedure as drawing 1 . The transmission-line frequency response calculation sections 13-15 compute a transmission-line frequency response peculiar to each branch #1-#n using this OFDM input-signal frequency spectrum and the reference frequency spectrum corresponding to OFDM input-signal frequency spectrum generated in the reference frequency spectrum generation section 21. The transmission-line frequency response of each branch #1-#n computed in the transmission-line frequency response calculation sections 13-15 is inputted into the filtering sections 23-25, and distortion of the noise added by each receive section 4-6 is removed. The transmission-line frequency response with which distortion of noise etc. was removed by the filtering sections 23-25 is inputted into the distortion compensation sections 16-18, respectively. The distortion compensation sections 16-18 compensate distortion included in the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 using the transmission-line frequency response after filtering.
[0071] The OFDM input-signal frequency spectrum generated by the 1st transducer 7-9 and the OFDM input-signal frequency spectrum after distortion compensation generated in the distortion compensation sections 16-18 are inputted into the selection section 19 as the 1st input signal A and 2nd input signal B, respectively. The selection section 19 outputs the OFDM input-signal frequency spectrum after distortion compensation which chooses a branch in the same procedure as the 1st operation gestalt shown in drawing 1 , and is inputted as the 2nd input signal from the selected branch. The recovery section 20 restores to the OFDM input-signal frequency spectrum after distortion compensation outputted from the selection section 19 for a digital signal sequence.
[0072] Thus, as a result of the transmission-line frequency response computed by each branch #1-#n by being distorted with the transmission-line frequency response calculation sections 13-15, and inserting the filtering sections 23-25 among the compensation sections 16-18 becoming more exact according to this operation gestalt, it becomes possible to improve degradation of a receiving property more exactly.
[0073] In addition, although this operation gestalt has the composition of having added the filtering sections 23-25 to the 2nd operation gestalt shown in drawing 4 , it is also effective to add the filtering section similarly to the 3rd and 4th operation gestalten shown in drawing 5 and drawing 6 . Furthermore, drawing 9 is available also as composition in which the reference frequency spectrum generation section is contained in each branch #1-#n of every like the 1st operation gestalt shown in drawing 1 , although the one reference frequency spectrum generation section 21 is shared by each branch #1-#n.
[0074] (Operation gestalt of the octavus) Drawing 10 is drawing showing the operation gestalt of the octavus of the OFDM diversity reception equipment concerning this invention. This operation gestalt has composition which inserted the filtering sections 23-25, respectively between the transmission-line frequency response calculation sections 13-15 and the selection sections 19 in the 5th operation gestalt shown in drawing 7 , in order to remove distortion of the noise included in a transmission-line frequency response like the 7th operation gestalt shown in drawing 9 .
[0075] In this operation gestalt, an OFDM input-signal frequency spectrum signal is computed by the 1st transducer 7-9 in #1 - #n in the same procedure as drawing 1 . The transmission-line frequency response calculation sections 13-15 compute a transmission-line frequency response peculiar to each branch #1-#n using the reference frequency spectrum corresponding to this OFDM input-signal frequency spectrum and the OFDM input-signal frequency spectrum generated in the reference frequency spectrum generation section 21.
[0076] The transmission-line frequency response computed in the transmission-line frequency response calculation sections 13-15 of each branch #1-#n is inputted into the filtering sections 23-25, and distortion of the noise added by each receive section 4-6 is removed. The transmission-line frequency response after OFDM input-signal frequency spectrum and the distortion removal from which distortion of noise etc. was removed by the filtering sections 23-25 is inputted into the selection section 19 as the 1st input signal and 2nd input signal, respectively. The selection section 19 outputs the OFDM input-signal frequency spectrum which chose the branch in the same procedure as the 5th operation gestalt shown in drawing 7 , and was inputted from the selected branch, and the transmission-line frequency response after distortion removal.
[0077] The distortion compensation section 22 compensates distortion of the OFDM input-signal frequency spectrum outputted from the selection section 19 using the transmission-line frequency response outputted from

the selection section 19. The recovery section 20 recovers a digital signal sequence from the OFDM input-signal frequency spectrum after distortion compensation outputted from the distortion compensation section 22.
[0078] Thus, as a result of the transmission-line frequency response computed by each branch #1-#n becoming accuracy more by inserting the filtering sections 23-25 between the transmission-line frequency response calculation sections 13-15 and the selection section 19 according to this operation gestalt, it becomes possible to improve degradation of a receiving property more exactly.
[0079] In addition, although this operation gestalt has the composition of having added the filtering sections 23-25 to the 5th operation gestalt shown in drawing 7 , it is also effective to add the filtering section similarly to the 6th operation gestalt shown in drawing 8 . Furthermore, drawing 10 is available also as composition in which the reference frequency spectrum generation section is contained in each branch #1-#n of every like the 1st operation gestalt shown in drawing 1 , although the one reference frequency spectrum generation section 21 is shared by each branch #1-#n.
[0080] The example of 1 composition of the filtering section used for > drawing 11 with the 7th or the operation gestalt of the octavus is shown about < filtering section. The filtering sections 50 of drawing 11 are the filtering sections 23-25 connected to the latter part of the transmission-line frequency response calculation sections 13-15 in each branch #1-#n in drawing 9 or drawing 10 , and the 2nd transducer 51, propagation-delay-time test section 52, filtering bandwidth setting section 53, and bandwidth consist of the adjustable filter sections 54.
[0081] The transmission-line frequency response computed by each branch #1-#n is inputted into the 2nd transducer 51 and filter section 54. In the 2nd transducer 51, the inputted transmission-line frequency response is changed by transform processing, such as an inverse Fourier transform, the information (transmission-line impulse response), i.e., the transmission-line time response, of a time domain. Generally this transmission-line time response is called delay profile, and expresses the number of paths in multiplex radio-wave-propagation environment. The delay profile which is the output of the 2nd transducer 51 is inputted into the propagation-delay-time test section 52, and the maximum time delay is measured from a delay profile here. Bandwidth is determined in the filtering bandwidth setting section 53 based on the measurement result of this maximum time delay, and the bandwidth of the filter section 54 is set up. A transmission-line frequency response is filtered by this filter section 54.
[0082] An improvement of a receiving property can be aimed at by becoming possible to remove efficiently, having distortion of the noise added to the transmission-line frequency response, and asking accuracy for a transmission-line frequency response more also in the propagation environment where a time delay changes, by having such the filtering section 50.
[0083] Operation of the 2nd transducer 51 in the filtering section 50 shown in drawing 11 is explained using drawing 12 . An example of the transmission-line frequency response computed in the transmission-line frequency response calculation sections 13-15 of each branch under 2 wave model environment where a request wave and one delay wave exist in drawing 12 (a) is shown. In a multi-pass propagation environment, a frequency-selective phasing phenomenon is caused, and since the interval is changed with the regular period, if this is changed into the information on a time domain by the 2nd transducer 51, it will be changed into a delay profile as shown in drawing 12 (b). Radio-wave-propagation environment can be grasped by this, a request wave and a delay wave are contained in a signal passband, and filtering bandwidth from which the other component is removed can be set up.
[0084] The filtering bandwidth setting section 53 sets up such filtering bandwidth to the filter section 54, and a transmission-line frequency response is filtered in this filter section 54. Thus, a more exact transmission-line frequency response is computable by oppressing through and an unnecessary component only for a required component.
[0085] (9th operation gestalt) Drawing 13 is drawing showing the 9th operation gestalt of the OFDM diversity reception equipment concerning this invention. This operation gestalt has become with the second-change tone frequency spectrum outputted from the second-change tone section 31 which carries out the second-change tone of the digital signal sequence outputted to the operation gestalt of the octavus shown in drawing 10 from the recovery section 20, and generates second-change tone frequency spectrum, and this second-change tone section 31, the frequency-spectrum selection section 32 which choose either of the reference frequency spectrum outputted from the reference frequency-spectrum generation section 21, and the composition which added in the delay sections 33-35.
[0086] That is, with the OFDM diversity reception equipment of this operation gestalt, the OFDM signal received by receiving antennas 1-3 in each branch #1-#n is inputted into receive sections 4-6, and the baseband signaling by which the guard period was removed from receive sections 4-6 is outputted. The output of receive sections 4-6 is inputted into the 1st transducer 7-9, and is changed into OFDM input-signal frequency spectrum by transform processing, such as a fast Fourier transform.
[0087] In the communication system and the broadcast system which transmit a digital signal sequence by the OFDM transmission system which adopted slot composition for example, if composition which includes a known data sequence at the head of a slot is assumed, when receiving the OFDM signal of the known data sequence The reference frequency spectrum frequency by which the reference frequency spectrum equivalent to a known data sequence was generated in the reference frequency spectrum generation section 21, and was generated is inputted into the transmission-line frequency response calculation sections 13-15 of each branch #1-#n through the spectrum selection section 32.
[0088] The output of the 1st transducer 7-9 of each branch #1-#n is inputted into the delay sections 33-35, and only 1 unit time (symbol time) is delayed. It is prepared in order to synchronize the delay sections 33-35 with delay

of the 1 unit time produced by carrying out the second change tone of the digital signal sequence to which it restored in the recovery section 20 in the second change tone section 31, and in computing a transmission-line frequency response using reference frequency spectrum, the existence of the delay sections 33-35 does not pose a problem.

[0089] A transmission-line frequency response is computed in the transmission-line frequency response calculation sections 13-15 by the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9, and the second change tone frequency spectrum which carried out the second change tone of the digital signal sequence to which it restored by the reference frequency spectrum or the recovery section 20 outputted from the frequency spectrum selection section 32. In each branch #1-#n, the transmission-line frequency response computed in the transmission-line frequency response calculation sections 13-15 is inputted into the filtering sections 23-25 for removing distortion of the noise added by receive sections 4-6. The filtering sections 23-25 remove distortion included in a transmission-line frequency response, and output the transmission-line frequency response after distortion removal.

[0090] Processing of the filtering sections 23-25 is the same as that of the content explained by drawing 11 or drawing 12 . The transmission-line frequency response after the distortion removal to which the OFDM input-signal frequency spectrum outputted from the 1st transducer 7-9 is outputted from the filtering sections 23-25 as the 1st input signal A is inputted into the selection section 19 as the 2nd input signal B, respectively.

[0091] The selection section 19 compares the OFDM input-signal frequency spectrum generated by branch #1 inputted as the 1st input signal A - #n, and chooses the branch by which the OFDM input-signal frequency spectrum from which an amplitude or power serves as the maximum was generated. The OFDM input-signal frequency spectrum and the transmission-line frequency response which were inputted from the selected branch are outputted from the selection section 19, and are inputted into the distortion compensation section 22. The distortion compensation section 22 compensates distortion of the OFDM input-signal frequency spectrum outputted from the selection section 19 using the transmission-line frequency response outputted from the selection section 19, and outputs the OFDM input-signal frequency spectrum after distortion compensation. The recovery section 20 recovers a digital signal sequence from the OFDM input-signal frequency spectrum after this distortion compensation.

[0092] As mentioned above, in the system transmitted with slot composition which includes a known data sequence at the head, about the data sequence after a known data sequence, modulation processing is again performed in the second change tone section 31, and it inputs into the transmission-line frequency response calculation sections 13-15 of each branch #1-#n through the frequency spectrum selection section 32. Generally this processing is called judgment feedback processing (decision DIREKUTEDDO processing), and is performed repeatedly. That is, a transmission-line frequency response is computed from the frequency spectrum of the digital signal sequence to which it restored at Time k, and the OFDM signal frequency spectrum received at Time k, and distortion included in the output of the 1st transducer of time k+1 is compensated based on this transmission-line frequency response.

[0093] Thus, according to this operation gestalt, also in dynamic propagation environment, a transmission-line frequency response [************] can be computed and it becomes improvable [a receiving property] by each branch #1-#n.

[0094] The bit error rate property which is the receiving property of the OFDM diversity reception equipment concerning the 9th operation gestalt shown in drawing 14 at drawing 13 is shown. It is the result of this bit error rate property's having set the modulation technique to QPSK, and defining Eb/No (dB) as a horizontal axis, defining a bit error rate BER as a vertical axis, and evaluating under the multi-pass propagation environment of independent 2 wave (fixed 2 wave model). tau in drawing shows the arrival time difference of two waves (a request wave and delay incoming wave), and D/U shows the power ratio of a request wave and an unnecessary wave (delay incoming wave). This drawing shows the case where it is the case where D/U is 0 (dB), and 5 (dB), respectively. By any D/U, when the diversity method of this invention is adopted, it turns out that the improvement effect of a very big receiving property is acquired.

[0095] in addition -- although it has the composition of having added the second change tone section 31, the frequency spectrum selection section 32, and the delay sections 33-35 to the operation gestalt of the octavus shown in drawing 10 , especially with this operation gestalt supposing reception in move receiving environment -- the 1- it is good also as composition which adds the second change tone section 31, the frequency spectrum selection section 32, and the delay sections 33-35 to the 6th operation gestalt

[0096]

[Effect of the Invention] As explained to the detail above, according to this invention, degradation of the receiving property produced in a multihop transmission environment is improvable by choosing the diversity branch from which the power or the amplitude of OFDM input-signal frequency spectrum or a transmission-line frequency response serves as the maximum, and performing diversity reception.

[Translation done.]